Combined ENSO, MJO, and trend influences on temperature and precipitation for probabilistic Weeks 3 and 4 forecasts

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In September 2015 the NOAA Climate Prediction Center began issuing experimental probabilistic temperature and precipitation forecasts for weeks 3 and 4. This initiative has heightened the need to identify sources of skill at these lead times and to transition this knowledge into operational forecast guidance in support of skillful forecasts. Through support from the NOAA Climate Test Bed (CTB), recent work suggests that the combined influence of the El Niño-Southern Oscillation (ENSO), Madden-Julian Oscillation (MJO), and long-term trend are important sources of predictability that can yield skillful forecasts in weeks 3-4 under certain initial tropical states

In this presentation, we discuss the prospects for skillful probabilistic forecasts in weeks 3-4 through CTB-funded development of two statistical tools. In the first, a probability density function (PDF) is conditioned on the temperature and precipitation means and variances for historical subsets within specified initial states of ENSO and the MJO. An additional shift to the PDF means is performed to account for long-term trend influences. A comparison can then be made for the PDF of the current climate state at the time for forecast is made, relative to the climatological PDF, with the difference between the two yielding adjusted forecast probabilities. While this first tool is often skillful it lacks information concerning amplitude of ENSO or the MJO. To account for potential subseasonal temperature and precipitation influence from ENSO and MJO strength, a complimentary second tool utilizing multiple linear regression with predictors of the base state Niño 3.4 index, two Real-time Multivariate MJO indices, and linear trend. Similar to the first tool, a Gaussian PDF is prescribed to the forecast anomalies, and then compared to climatology to yield forecast probabilities relative to normal.

Our analysis reveals potentially skillful probabilistic forecasts based on each tool for both temperature and precipitation at weeks 3 and 4 throughout the year for varied regions and initial climatic states. The two statistical tools are often complimentary to one another in terms of skillful geographic regions. We then discuss the successful transition of these statistical tools into operational forecast guidance and their ongoing role in weeks 3-4 forecasting.